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| <p>Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering</p> |  | المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة |
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Thermal Power Plants

College: Engineering

Department: Mechanical

First: Course Definition

1- Course Code : ME675

2- Units : 3 credit hrs

3 – Semester

4 -Prerequisite : None

5- Co-requisite: None

6- Location (if not on main Campus): N/A

Second: Course Objectives

1. To provide students with the basic principles required for understanding different power generation methods on the traditional and renewable sources base;
2. To provide students with the required skills for analyzing thermal power plants, estimating the economic efficiency and to select the optimal solution for concrete conditions;
3. To make the student familiar with the different components of thermal power plant and have the appropriate skills for design, operating, maintenance and troubleshooting such components.
4. To make students understand a power plant, examine their heat and mass balance flow diagram, plant major components, and recognize their specific functions and limitations.

Third: Course Specifications

| 1- Topics to be covered | | |
|-------------------------|-------------|-------|
| Subject | No of Weeks | Units |
| Thermodynamics review | 1 | 3 |

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| <i>Forms of energy, oil, gas and coal.</i> | 1 | 3 |
| <i>Combustion processes, gas power plants, steam power plants.</i> | 2 | 6 |
| <i>Combined power plants.</i> | 2 | 6 |
| <i>Nuclear power plants.</i> | 1 | 3 |
| <i>Steam generators and their component design.</i> | 2 | 6 |
| <i>Turbines.</i> | 2 | 6 |
| <i>Load curves and power plant economy</i> | 1 | 3 |
| <i>Matching of power plant elements.</i> | 1 | 3 |
| Project: <i>thermal analysis and performance of Buraydah central power station</i> | 2 | 6 |

2- Course components (Total hrs in the Semester)

| Lecture | Exercise or lab | Other | Total |
|---------|-----------------|-------|-------|
| 45 | --- | - | 45 |

3- Intended Learning Outcomes of the Course (ILO's)

a. Knowledge

i) Description of the knowledge to be acquired:

On successful completion of this course, students should be able to:

- Outline the basics, theory and physical concepts of steam, gas turbine and nuclear power plants.
- Recognize the different configurations of steam, gas turbine and combined cycle power plant.
- Understand and analyze the Rankine cycle applied for steam power plants
- Recognize the different configurations of steam generators and their applications.
- Understand, analyze and cooling blades of Brayton cycle applied for gas turbine power plants.
- Understand and analyze the steam condensers and cooling towers.

ii) Teaching strategies to be used to develop that knowledge

- Class lectures.
- Reading assignments.
- Interacting with student in class (active Learning)
- Reports

iii) Methods of assessment of knowledge acquired

- Assignments
- Reports
- Quizzes
- Group Project

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b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

On successful completion of this course, students should be able to:-

- Analyze the different types of power plants.
- Differentiate between the conventional power plants.
- Design different components of the thermal power plants.
- Construct energy storage systems
- Construct load curve and cost analysis of kWh

ii) Teaching strategies to be used to develop these cognitive skills

- Class lectures.
- Tutorial sessions
- Case study (data collection, Internet search, and reporting)
- Problem assignments and Students' presentations.
- Reports.
- Group discussion.

iii) Methods of assessment of students cognitive skills

- Exams.
- Quizzes.
- Homework
- Assignments.

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

On successful completion of this course, students should be able to:

- Participate in class discussions with colleagues and with teachers.
- Work in team
- Develop ideas and share with others
- Appreciate the need for make use of thermal power plants and its optimal use.
- Recognize the conflicting issues between using energy and environmental issues

ii) Teaching strategies to be used to develop these skills

- Class lectures.
- Reading assignments and Students' presentations.
- Case study (data collection, Internet search, and reporting)
- Problem assignments and Students' presentations.

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- Reports.

iii) Methods of assessment of student's interpersonal skills and capacity to carry responsibility

- Exams.
- Quizzes.
- Homework
- Assignments.

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- On successful completion of this course, students should be able to:
- Use of the internet search for course related issues.
 - Write acceptable technical report.
 - Verbally present technical report.

ii) Teaching strategies to be used to develop these skills

- Reading assignments and Students' presentations.
- Case study (data collection, Internet search, and reporting)
- Reports.
- Group discussion.

iii) Methods of assessment of students numerical and communication skills

- Homework
- Assignments.

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

Not Applicable

ii) Teaching strategies to be used to develop these skills-

Not Applicable

iii) Methods of assessment of student's psychomotor skills

Not Applicable

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4- Student Assessment Schedule

| Serial | Assessment tool (test, group project, examination etc.) | Week due | Weight |
|--------|--|-------------------------------------|--------|
| 1 | Four quizzes | Weeks 5, 8, 9 and 14 | 10 % |
| 2 | Two mid-term exams | Weeks 6 and 12 | 20 % |
| 3 | Mostly eight assignments (in-class/out-class) and homework. This number may increase according to the instructor view. | Weeks 3, 5, 7, 9, 11, 12, 14 and 15 | 16 % |
| 4 | Attendance | All weeks | 4 % |
| 5 | Final Exam | Week 16 | 50% |

5- Student Support

Four office hours per week are offered by the instructor to aid the students and support them. University data base access (electronic library of textbooks and scientific periodicals).

6- Learning Resources

i) Essential Books (References)

- [1] *El-Wakil, Power Plant Technology, McGraw-Hill, 1984.*
- [2] *William W. Bathie, Fundamentals of Gas Turbine, John Wiley & sons, 1990.*
- [3] *Steam, Its Generation and Use, Babcock & Wilcox Company, 1978.*

ii) Course Notes

- None
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iii) Recommended Books

- [1] *El-Wakil, Power Plant Technology, McGraw-Hill, 1984.*
- [2] *William W. Bathie, Fundamentals of Gas Turbine, John Wiley & sons, 1990.*
- [3] *Steam, Its Generation and Use, Babcock & Wilcox Company, 1978.*

iv) Electronic Books & Web Sites:

<http://onlinebooks.library.upenn.edu/webbin/book/lookupid?key=olbp33597>

v) Periodicals

- ASME Transactions, Journal of Gas Turbine and power plants

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- [www. Elsevier.com/Energy](http://www.Elsevier.com/Energy)
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7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students questionnaires,
- Appeal box

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Instructor course evaluation report by the end of the course
- Periodical (semester/annual) review of the department subject committee

iii) Processes for Improvement of Teaching

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- The educational continuous improvement process which applied in the department according to the ABET criteria are also applied here, moreover
- Evaluation of the course outlines by external staff member from outside the university
- Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.

iv) Processes for verifying standards of student achievement (e.g. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

- Check marking by an independent faculty member of a sample of student work

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Through a committee of evaluation in checking the outcomes.
- Through the students` assessment for continuous improvement process.